

## **Case Report**

### **Major Cardiac and Vascular complications of chest tube drainage**

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**Abstract:** Chest tube thoracostomy is often a lifesaving procedure as well pericardial drainage for pericardium effusion. Unfortunately, these procedures are also associated with significant morbidity and mortality. Authors reported 2 cases of major cardiac and vascular complications. Inadequate training and lack of experience lead to severe complications with injury of the heart or great vessels. For chest tube drainage, Trocar technique is known to be more dangerous than blunt chest dissection. Anatomical deformities and modifications can also increase the risk of major injuries of chest drainage. Pulmonary artery perforation following chest tube insertion is a rare and serious complication. Management of these major emergencies should be fast and adequate. In pulmonary wound case, use of cardiopulmonary bypass allows good hemodynamic and efficient perfusion while repair is done securely. Cardiopulmonary bypass is not always necessary to get perfect hemostasis. For cardiac injury, excellent repair and perfect hemostasis could be obtained without the need for cardiopulmonary bypass.

**Keywords:** chest tube drainage, pericardial drainage, cardiac and vascular injuries.

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## **INTRODUCTION**

Chest tube thoracostomy is often a lifesaving procedure as well pericardial drainage for pericardium effusion. Unfortunately, these procedures are also associated with significant morbidity and mortality[1]. Major cardiac and vascular injuries are rare but dramatic when they occurred in chest tube drainage. Authors reported 2 cases of cardiovascular chest tube-induced wounds in order to analyze the causes of such serious complications and their adequate management.

## **Case reports:**

### **Case 1:**

A 13 years old teenager was admitted at Pediatric Center for pericarditis, pneumonia with fever and severe condition. A pericardial drainage was done with a tube using trocar technique. Quickly 500 ml of blood was drained. With this cardiac injury suspicion, the tube was clamped and the patient sent to our center (figure 1).



**Fig-1: Showing Tube clamped after suspicious right ventricle perforation**

The duplex scan showed the tube inside the right ventricle, laying on the inter ventricular septum with a

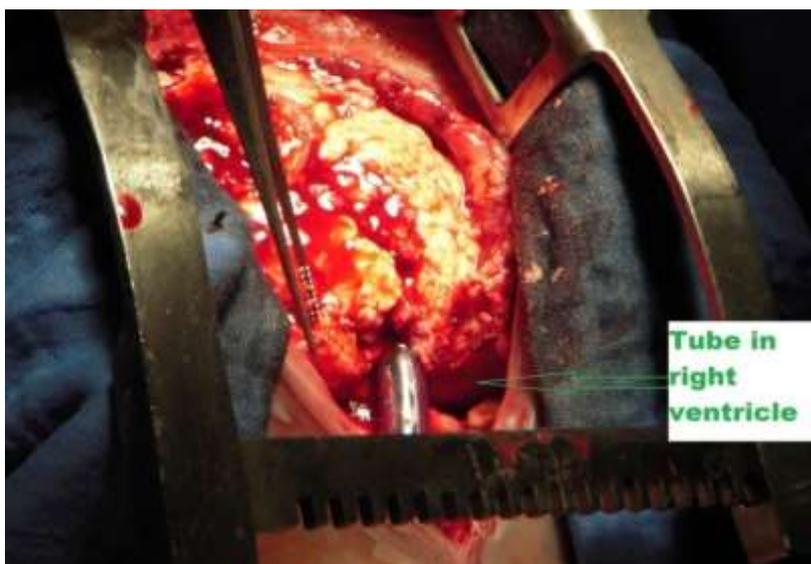
clot on the tip (figure 2).The pericardium was thick, dense with massive pericardial effusion.



**Fig-2: Showing Duplex scan image of tube and thrombus in right ventricle injury**

Surgical exploration was done over a median sternotomy, and showed constrictive pericarditis. The

tube was seen inside the right ventricle, with diaphragm perforation (figure 3).



**Fig-3: Showing Operative view of right ventricle perforated by tube, with thick pericardium**

One liter of purulent liquid was aspirated from the pericardial cavity. The cardiac wound was repaired in beating heart without cardiopulmonary pump with running stitches of polypropylene, after removing of the tube. A complementary anterior pericardectomy was done in the same time. He received blood transfusion. In post-operative, a duplex scan was done, and was normal. The next day the patient deceased from septic shock.

**Case 2:**

A 50 years old gentleman was admitted to Emergency room, after car crash. He presented with several rib fractures, diaphragmatic hernia, abdominal

contusion, pulmonary contusion and left hemothorax. The hemodynamic status was stable. CT scan and laparotomy confirmed diaphragm hernia which was repaired. A chest tube was placed over the left 5<sup>th</sup> intercostal space using trocar technique. The evolution was good and the tube removed 2 days later. But 3 days after tube removing, the X-ray showed recurrence of the hemothorax. Another chest tube was then placed using the same technique thru the 3<sup>rd</sup> intercostal space on anterior axillary line. It produced 2300 ml of blood, with cardiovascular collapse. The tube was then clamped and blood transfusion was done. Then, le patient was sent to our facility.

The CT scan showed a left pulmonary artery perforation with the tube inside the vessel, associated

with left hemothorax (figure 4).

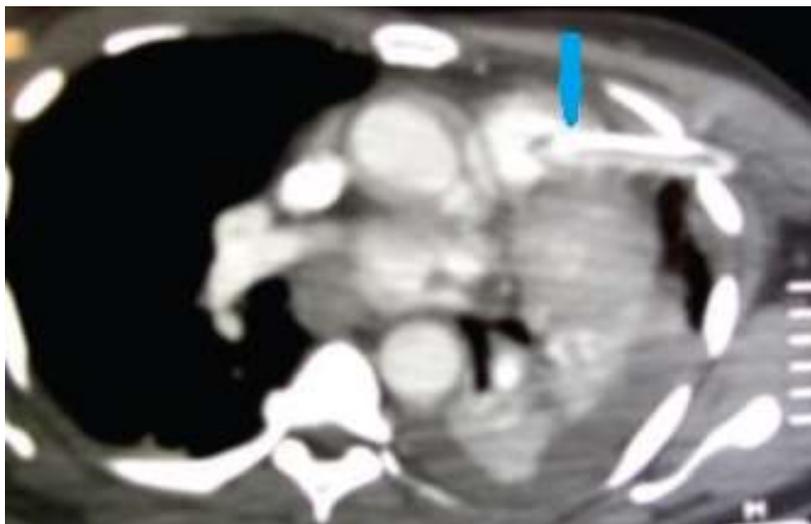


Fig-4: Showing CT scan image of tube in pulmonary artery perforation after chest drainage

He underwent surgery 3 hours after the accident. Over a sternotomy, with cardiopulmonary bypass, a 1 cm perforation of the pulmonary artery trunk was found (figure 5), with big hemothorax. The

pulmonary artery was dissected and clamped, and then the pulmonary artery wound repaired with pledgets reinforced stitches. Post-operative period was free of events.

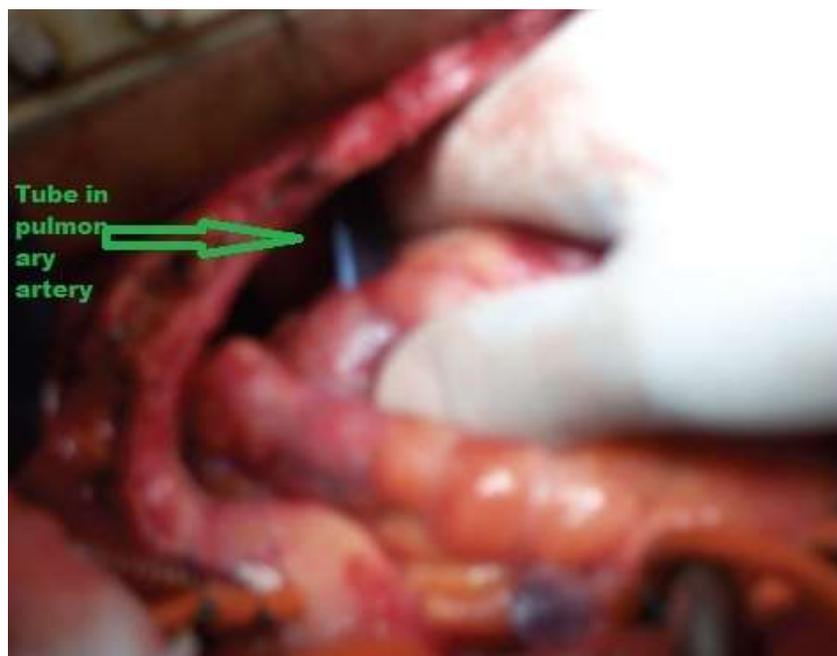


Fig-5: Showing Operative view of pulmonary artery perforated by chest tube

## DISCUSSION

Tube thoracostomy and pericardial drainage are lifesaving chest tube drainages. Such procedures may be done by general surgeons, intensivists, emergency physicians, and respiratory physicians at one time or the other [2], instead of cardiovascular or thoracic surgeons. Unfortunately, inadequate training and lack of experience lead to severe complications with injury of the heart or great vessels. In both cases reported, the tube drainage was done by general or

pediatric surgeons who are not comfortable with this procedure.

Polytraumatism with blunt chest injury and inappropriate training have each been identified as risk factors for chest tube-related morbidity [3]. In this reported case, the chest tube drainage was done in risky conditions: by general surgeon, in Emergency room, on a patient with severe thoracic trauma deforming the chest. For chest tube drainage, Trocar technique is

known to be more dangerous than blunt chest dissection [4]. The structure of the trocar with sharp tip may lead to injury. Extreme caution is mandatory. Most major pulmonary vascular injury has been reported in literature due to the use of trocar-based thoracostomy tubes [5].

The blunt chest wall dissection technique which is widely used for chest tube drainage is safer than trocar-based technique. For the pericardial drainage case, the operator used an inadequate technique. Trocar technique shouldn't ever been used for this case. The pericardium can be opened and drained without trocar as pericardium is surgically exposed. The right ventricle is just ahead!

Anatomical deformities and modifications can also increase the risk of major injuries of chest drainage. Dense pleural adhesion prevents the normal entry into the pleural space leading to lung penetration and subsequent perforation of the pulmonary artery. In pulmonary artery case, important pleural adhesions prevented the entry of the trocar into the pleural space, and forceful insertion beyond the chest wall led to dissection of the lung and perforation of the pulmonary artery [5].

Extreme caution is warranted when tube thoracostomy is carried out in patients with thoracic deformities. Management of that major emergency should be fast and adequate. "Should an unfortunate event such as major cardiovascular structure penetration occur, an emergency thoracotomy should be immediately performed" [6]. These vascular and cardiac accidents induce major hemorrhage with unstable hemodynamic status. Resuscitation actions are mandatory. Without vigorous response, heart wound leads to immediate return and continuous stream of blood emerging from the chest tube leading to marked hypotension, hemorrhagic shock, and death [7]. Pulmonary artery perforation following chest tube insertion is a rare and serious complication.

The aim of surgery is to repair the pulmonary artery. If this is not feasible, then a pneumonectomy may be performed. In this pulmonary wound case, use of cardiopulmonary bypass allows good hemodynamic and efficient perfusion while repair is done securely. Cardiopulmonary bypass is not always necessary to get perfect hemostasis [8]. Also, the tube occluding the perforation with clot around settled a lucky situation.

Pledged polypropylene suture should be placed and tightened around the puncture site while the drain is withdrawn. Pneumonectomy could be performed instead of pulmonary artery primary repair [7] when the accident may have produced the infarct in the parenchymal territory, and when artery repair is too dangerous in the case of severe dissection of the artery. It was reported in literature non-operative management

of pulmonary artery injury by a trial of catheter removal with a backup plan[5], but surgical repair should be the first option.

Cardiac repair of tube-induced heart wound is done over sternotomy access with potentially need for cardiopulmonary bypass. However, as in this case, excellent immediate repair and perfect hemostasis could be obtained without the need for cardiopulmonary bypass [8].

## CONCLUSION

Chest tube drainage and pericardial drainage are widely used as lifesaving procedure. In difficult conditions they may lead to major vascular or cardiac injuries. However, good management with fast and adequate vascular or cardiac repairs could give positive outcomes.

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